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Laser-to-Electricity Energy Converter for Short Wavelengths

The problem:

Lasers might ultimately be used to transmit power collected in space to receptors on Earth or to transmit power to spacecraft. Short-wavelength lasers are preferable for this purpose because they disperse less. However, current p-n junction photovoltaic devices used to convert laser energy to electrical energy are not efficient at wavelengths shorter than $0.6 \mu\text{m}$.

The solution:

A short-wavelength energy converter can be made using a Schottky barrier structure. It has a wider band gap than p-n junction silicon semiconductors, and thus it has an improved response at wavelengths down to and including the ultraviolet region.

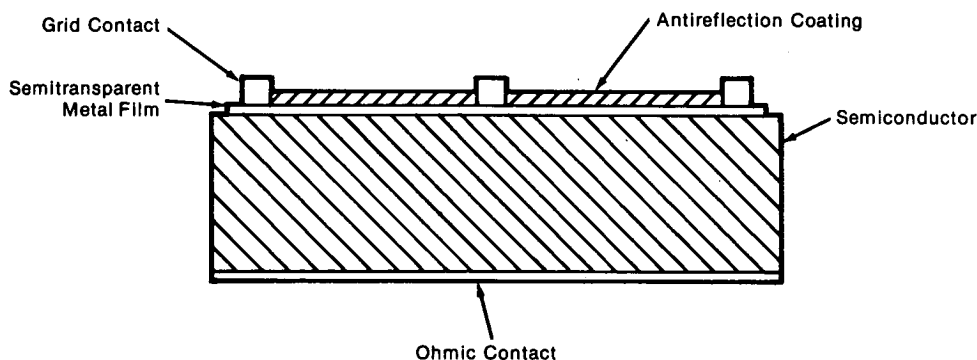
How it's done:

The Schottky barrier consists of a $50\text{-}\text{\AA}$ to $60\text{-}\text{\AA}$ semitransparent metal film evaporated onto a semiconductor, such as GaAs, $\text{Ga}_{1-x}\text{Al}_x\text{As}$, $\text{GaAs}_{1-x}\text{P}_x$, or an even wider band semiconductor such as GaP. A

schematic cross section of the energy-conversion cell is shown in the illustration. One contact is a grid placed on the metal film to reduce sheet resistance, and the other is a wide-area ohmic contact on the back of the cell. An antireflection coating minimizes reflection losses; its thickness and index of refraction depend on the optical properties of the metal film and the semiconductor.

Gold, palladium, or platinum are examples of metals that can be used as the metal film. The particular metal used should form a stable high-energy barrier. The optimum thickness depends on two conflicting properties: (1) light transmission requiring a thin film and (2) low sheet resistance dictating thicker films.

These devices can be constructed at room temperature, and the alloy composition is relatively easy to control. The Schottky barrier converter has excellent short-wavelength response and does not exhibit the problems of p-n junctions caused by the heavily doped diffused region.



Schottky Barrier Laser Energy Converter

(continued overleaf)

Note:

Requests for further information may be directed to:

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Reference: TSP75-10119

Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

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